

THE CRINOIDS

COLLECTED BY THE *ENDEAVOUR* BETWEEN
FREMANTLE AND GERALDTON
(WESTERN AUSTRALIA).

By AUSTIN HOBART CLARK.

PREFACE.

Mr. Bernard H. Woodward, the Director of the Western Australian Museum and Art Gallery at Perth has recently honoured me with a request to examine a collection of comatulids or unstalked crinoids brought together by the *Endeavour* while working along the coast of Western Australia between Fremantle and Geraldton.

Mr. Wilfrid B. Alexander accompanied the *Endeavour* at the time the collection described herein was made, taking careful colour notes on many of the specimens. These he has been kind enough to permit me to incorporate herein.

Within the past two years the Australian crinoid fauna has received a considerable amount of attention; in 1911 there was published at Sydney a comprehensive monograph on the crinoids of Australia, including a historical introduction, a complete synonymy and a bibliography; every Australian record of a crinoid or of a supposed crinoid is given. At the same time there was published a memoir upon the crinoid fauna of Australia west of 140°E. long., based upon the collection made by the Hamburg West Australian Expedition under Drs. W. Michaelsen and R. Hartmeyer in 1905. In this memoir every record of a crinoid in the region under consideration is included, and the faunas of the various coasts of the continent are compared. In 1912 a paper on the crinoids preserved in the Naturhistorisches Museum, at Hamburg, appeared in which the following new records were included: *Comaster belli*, from Houtman's Rocks; *Comanthus samoanu*

(not previously known from Australia), from Houtman's Rocks; and *Petasometra helianthoides* (gen. et. sp. nov.) from Shark Bay; other species were listed from localities where they were already known to occur, or from localities within their ascertained range. In another paper a new species of *Zygometra*, *Z. punctata*, was described from the Aru Islands where it had been collected by the *Siboga*, and at the same time was recorded from Port Curtis, Queensland, and from Holothuria Bank in north-western Australia. In 1913 a supplement to the memoir on the crinoids of south-western Australia was published in which some additional specimens collected by Drs. Michaelsen and Hartmeyer were recorded and the information regarding the crinoid fauna of this region was brought up-to-date.

THE ENDEAVOUR COLLECTION.

The present collection contains representatives of twelve species included in nine genera and eight families and sub-families, as follows:—

Family: COMASTERIDAE.

Sub-family: CAPILLASTERINAE.

Capillaster sentosa (P. H. Carpenter).

Capillaster multiradiata (Linné).

Sub-family: COMACTINIINAE.

Comatulella brachiolata (Lamarck).

Comatula purpurea (J. Müller).

Sub-family: COMASTERINAE.

Comanthus (Vania) annulata (Bell).

Comanthus (Vania) parvicirra (J. Müller).

Family: ZYGOMETRIDAE.

Zygometra elegans (Bell).

Family: HIMEROMETRIDAE.

Amphimetra discoidea (A. H. Clark).

Family: TROPIOMETRIDAE.

Tropiometra afra (Hartlaub).

Family: CALOMETRIDAE.

Neometra gorgonia, sp. nov.*Neometra conaminis*, sp. nov.

Family: THALASSOMETRIDAE.

Ptilometra macronema (J. Müller).

These species fall naturally into the following classes:—

EAST INDIAN SPECIES.

Capillaster sentosa.*Comanthus annulata*.*Capillaster multiradiata*.*Comanthus parvicirra*.

AUSTRALIAN TROPICAL SPECIES.

Comatula purpurea.*Tropiometra afra*.*Zygotmetra elegans*.? *Neometra gorgonia*.*Amphimetra discoidea*.? *Neometra conaminis*.

SOUTH AUSTRALIAN SPECIES.

Comatulella brachiolata.*Ptilometra macronema*.

The family Calometridae was not previously known to occur on the Australian coasts, though it was to be expected that it would be discovered as soon as dredging operations were carried into sufficiently deep water.

Capillaster sentosa also is new to the Australian coasts, though in view of its wide range in the East Indian region its presence here is not surprising.

Tropiometra afra, though only known from Australia, has been previously reported only from Bowen, Queensland; its occurrence on the west coast, and so far to the southward is therefore a matter of considerable interest.

The known range of *Capillaster multiradiata* has been extended southward from Dirk Hartog Island, and the occurrence of *Comatulella brachiolata*, *Comatula purpurea*, *Comanthus annulata*, *Zygotmetra elegans* and *Amphimetra discoidea* in the vicinity of Perth, about which there had previously been some question, has been established.

DESCRIPTION OF SPECIES COLLECTED.

Fam.: COMASTERIDAE, A. H. Clark.

Sub-fam.: CAPILLASTERINAE, A. H. Clark.

Genus: CAPILLASTER, A. H. Clark.

CAPILLASTER SENTOSA, P. H. Carpenter.

Comatula multiradiata (part) 1816. Lamarck, Hist. nat. des animaux sans vertèbres, vol. 2, p. 533.

Comatula (Alecto) multiradiata (part) 1849. J. Müller, Abhandl. d.k. preuss. Akad. d. Wiss. (1847), p. 261.

Actinometra sentosa, 1888. P. H. Carpenter, Challenger Reports, vol. 26, Zoology, p. 325, pl. lxvi., figs. 4-6.

Capillaster sentosa, 1912. A. H. Clark, The Crinoids of the Indian Ocean, p. 73.

Differential Characters. *Capillaster sentosa* has the same curious arm structure as *C. multiradiata*; the IIBr series (the series following the first or "radial" axillary) are 4 (3 + 4), and all the succeeding division series are 3 (2 + 3); the first brachial of the free undivided arms, and the first ossicles following all the axillaries except the first (IBr or "radial" axillary), bear pinnules. It differs from *C. multiradiata* in possessing a much larger centrodorsal, which bears longer and stouter cirri, with between 30 and 40 (commonly about 35) segments, and much more numerous arms, these ranging from thirty to, about eighty (most commonly between forty and sixty-five in number).

Locality. Between Fremantle and Geraldton.

Material. Two specimens; one of these is small, but typical, with seventy-three arms; one of the IIBr series is 2, and the remaining nine are 4 (3 + 4); the following series are all 3 (2 + 3); the other has thirty-three arms 115 mm. long; there are nine IIBr series, all 4 (3 + 4), and thirteen IIIIBr series, all 3 (2 + 3); the centrodorsal is typically large and hemispherical; the cirri are 27 mm. to 30 mm. long, and are composed of 28-30 segments.

Distribution. *Capillaster sentosa* ranges from the Maldivé Islands eastward as far as the Philippines and the Moluccas, and southward to south-western Australia.

Remarks. This is the first record for this species in Australia, though its occurrence there was to have been expected.

CAPILLASTER MULTIRADIATA (Linné).

Capillaster multiradiata, 1911. A. H. Clark, The Recent Crinoids of Australia, p. 736. 1911. A. H. Clark, Ergebnisse der Hamburger sudwest-Australischen Forschungsreise, 1905, Bd. 3, Lief. 13, S. 445. 1912. A. H. Clark, The Crinoids of the Indian Ocean, p. 74.

Locality. Between Fremantle and Geraldton.

Material. Three specimens. One of these has twenty-five arms 110 mm. long; there are eight IIBr. series present, four of them 4 (3+4) and four 2; there are six IIIBr. series, five 3 (2+3) and one 2; there is one IVBr. series of 3 (2+3) following a IIIBr. series of 2: the cirri are XIII, 22+26, 15 mm. to 20 mm. long; the second has twenty-five arms about 100 mm. long; of the ten IIBr. series eight are 4 (3+4) and two are 2; the five IIIBr. series are 3 (2+3); the cirri are XVI, 20+21, 17 mm. long; the third is smaller and broken, but is similar to the others.

Remarks. This species has not previously been recorded from further south than Dirk Hartog Island, where the German steamer *Gazelle* dredged it in 7 fathoms.

Sub-fam.: COMACTINIINAE, A. H. Clark.

Genus: COMATULELLA, A. H. Clark.

COMATULELLA BRACHIOLATA (Lamarck).

Comatula brachiolata, 1911. A. H. Clark, The Recent Crinoids of Australia, p. 742. 1912. A. H. Clark, The Crinoids of the Indian Ocean, p. 79.

Comatulella brachiolata, 1911. A. H. Clark, Ergebnisse der Hamburger sudwest-australischen Forschungsreise, 1905, Bd. 3, Lief. 13, S. 447.

Locality. Between Fremantle and Geraldton.

Material. One fine specimen; the centrodorsal is thick discoidal, the dorsal pole large, very slightly convex (almost flat), 5 mm. in diameter.

The cirri are XVIII, 35-37 (usually the latter), 15 mm. to 18 mm. long; they are arranged in one (with a partial second) irregular marginal row. All of the component segments are much broader than long. The cirri taper markedly for the first seven segments.

The mouth is radial, situated at the base of the anterior arm pair.

The arms are all of equal length and size, 85 mm. long, 2.5 mm. wide at the base, and 4.3 mm. wide at the broadest place, between the twelfth and fourteenth brachials.

The terminal comb on the proximal pinnules is composed of fifteen teeth which are long and slender, shaped like an arrow head with the point truncated.

All the arms bear ungrooved pinnules in equal numbers. In the proximal portion of the arms the pinnules on either side typically alternate, grooved and ungrooved; further out there are two grooved pinnules between adjacent ungrooved pinnules, and toward the arm tips all the pinnules are grooved.

There is a very great difference in the structure of the grooved and ungrooved pinnules, which is well shown in the more proximal portion of the arm where the two types regularly alternate. The grooved pinnules, after the first two segments, which are rather large, are slender, delicate and very flexible; the ungrooved pinnules have slightly larger basal segments than the grooved and taper very gradually so that they are much stouter than the delicate grooved pinnules; at first they lie horizontally, but in the distal half or third they curve dorsally into the form of a hook or spiral, exactly as do the cirri, forming tendril-like attachments all along the arm whereby the animal fixes each arm securely to the organisms on the sea-floor in addition to fixing its central portion by means of its cirri.

The segments of the stout grooveless pinnules are produced dorsally into blunt rounded processes exactly resembling the dorsal convex swellings on the outer cirrus segments; these are perfectly smooth, with no trace of spines; these processes are entirely absent from the slender grooved pinnules which, instead, bear on the dorsal side of the terminal segments the long recurved spines characteristic of the pinnules of all the species of this family.

The colour in life was purplish red, the centrodorsal and first seven segments of the cirri darker and more brownish, the distal portion of the cirri bright red.

Remarks. Morphologically the first two segments of the pinnules are merely atrophied brachials, while the remaining

portion of the pinnules, including the third and succeeding segments is merely a tentacular body process, exactly comparable to the cirri, but carrying ambulacral structures on its ventral side.

Each brachial originates as, and is fundamentally, an axillary; one of the two derivatives from this axillary, after the formation of two ossicles, which are united to each other just as are the paired ossicles in the division series, abruptly ceases its development, while the other continues to increase in size, its basal segment attaining the same diameter as the brachial upon which it rests. The atrophied branch from the original axillary stage of the growing brachial serves as the base from which there extends outward a long tentacular structure with no phylogenetic history, which forms within itself a series of skeletal braces as necessity requires, and which is in every way exactly comparable to a cirrus, which also is a long tentacular structure with no phylogenetic history forming within itself a series of skeletal braces as necessity requires, excepting only that it bears ambulacral structures along its ventral surface.

Since pinnules beyond the second segment are merely elongate tentacular processes in which a skeleton is formed as needed, and cirri are also elongate tentacular processes in which a skeleton is formed as needed, it necessarily follows that the skeleton of the two sets of organs will be essentially identical, differing only in such modification as will enable the pinnule to carry ambulacral organs on its ventral side; and, further, that if for any reason the pinnules are not supplied with ambulacral organs on their ventral side the difference between the cirri and the pinnules beyond the second segment will almost or entirely disappear.

In this connection it is most instructive to see that in this specimen the ungrooved pinnules have approached so closely to the cirri in structure that they have taken upon themselves the performance of exactly the same functions.

Genus: COMATULA, Lamarck.

COMATULA PURPUREA, J. Müller.

Comatula purpurea, 1911. A. H. Clark, The Recent Crinoids of Australia, p. 746, 1911. A. H. Clark, Ergebnisse der Hamburger sudwest-Australischen Forschungsreise, 1905, Bd. 3, Lief. 13, S. 451. 1912. A. H. Clark, The Crinoids of the Indian Ocean, p. 81.

Locality. Between Fremantle and Geraldton.

Material. Four specimens; one of these is typical, with VIII cirri, three in interradiial pairs and two single; another has XI cirri; the cirri in the other two are more numerous than usual, but are evidently undergoing reduction toward the condition normal for the species, indeed in the larger the normal arrangement occurs on about four-fifths of the periphery of the centrodorsal.

In the largest specimen the anterior arms are about 100 mm. long.

The colour in life was reddish purple.

Sub-fam.: COMASTERINAE, A. H. Clark.

Genus: COMANTHUS, A. H. Clark.

Sub-genus: COMANTHUS, A. H. Clark.

Specific Group: VANIA, A. H. Clark.

COMANTHUS (VANIA) ANNULATA, Bell.

Comanthus (Vania) annulata, 1911. A. H. Clark, The Recent Crinoids of Australia, p. 757. 1911, A. H. Clark, Ergebnisse der Hamburger sudwest-Australischen Forschungsreise 1905, Bd. 3, Lief. 13, s. 457.

Comanthus annulata, 1912. A. H. Clark, The Crinoids of the Indian Ocean, p. 96.

Locality. Between Fremantle and Geraldton.

Material. Nine specimens; two of these are uniform light yellowish brown; the other seven are yellowish brown, darkest on the calyx, division series and arm bases where they are thickly covered with small uniform round green spots; according to the label these were dull green in life.

The details of the specimens are as follows: (1) about forty-five arms about 110 mm. long; VI cirri; (2) forty arms about 110 mm. long; X cirri; (3) about forty arms; one of the IIIBr.

series is 7 (3+4, 6+7); the centrodorsal is a pentagonal plate slightly raised above the surface of the radials, with a few obsolete cirrus sockets about its periphery; (4) about forty arms; the centrodorsal is very thin discoidal, pentagonal in outline; there are III cirri; (5) about thirty-five arms about 110 mm. long; (6) about thirty-five arms about 90 mm. long, the centrodorsal is greatly reduced; there are III cirri; (7) about thirty-five arms; VIII cirri; the centrodorsal is greatly reduced; (8) about thirty arms; V cirri; (9) about twenty-five arms about 115 mm. long.

Remarks. These specimens agree with those taken by the Hamburg West Australian Expedition at Shark Bay, and with others which I have examined from the vicinity of Perth.

COMANTHUS (VANIA) PARVICIRRA, J. Müller.

Comanthus (Vania) parvicirra, 1911. A. H. Clark, The Recent Crinoids of Australia, p. 758. 1911, A. H. Clark, Ergebnisse der Hamburger sudwest-Australischen Forschungsreise 1905, Bd. 3, Lief. 13, s. 446.

Comanthus parvicirra, 1912, A. H. Clark, The Crinoids of the Indian Ocean, p. 97.

Locality. Between Fremantle and Geraldton.

Material. One typical specimen with twenty-two arms 70 mm. long; of the ten IIBr. series seven are 4 (3+4) and three are 2; there are two IIIBr. series, one 2, developed internally, and one 4 (3+4), developed externally; the cirri are VIII, 14, 7 mm. long.

Remarks. This species has previously been recorded from Fremantle.

Fam. : ZYGOMETRIDAE, A. H. Clark.
Genus : ZYGOMETRA, A. H. Clark.

ZYGOMETRA ELEGANS, Bell.

Zygometra elegans, 1911. A. H. Clark, The Recent Crinoids of Australia, p. 762. 1911, A. H. Clark, Ergebnisse der Hamburger sudwest-Australischen Forschungsreise 1905, Bd. 3, Lief. 13, s. 458. 1912, A. H. Clark, The Crinoids of the Indian Ocean, p. 104.

Locality. Between Fremantle and Geraldton.

Material. Eight specimens; the details of these are as follows: (1) forty-five arms 110 mm. long; of the ten IIBr. series

nine are 4 (3+4) and one is 2; of the twenty IIIBr. series seventeen are 2 and three are 4 (3+4); the five IVBr. series are all 4 (3+4); four of them are developed on the outermost side of the ray, the fifth being by the side of one of these; the centrodorsal is large, thick discoidal, the dorsal pole slightly concave, 5 mm. in diameter; the cirri are 30 mm. to 35 mm. in length, and are composed of 44-47 segments; PD is rather slender, about 15 mm. long, composed of from twenty-seven to twenty-nine segments; (2) forty arms about 100 mm. long; of the ten IIBr. series seven are 4 (3+4) and three are 2; sixteen of the IIIIBr. series are 4 (3+4) and two are 2; two are missing; the cirri are 30 mm. to 33 mm. long, and are composed of 37-42 segments; PD is 18 mm long, rather slender, composed of thirty-seven segments; (3) forty arms about 100 mm. long; the ten IIBr. series are 4 (3+4); twelve of the IIIIBr. series are 2 and six are 4 (3+4); the two IVBr. series are 4 (3+4); the cirri are about 30 mm. long and are composed of 38-39 segments; the elongate proximal pinnules are slender; (4) two of the post-radial series are missing; the three post-radial series present consist of eight arms each, two IIBr. and four IIIIBr. series being present in every case; all of the IIBr. series are 4 (3+4); nine of the IIIIBr. series are 2 and three are 4 (3+4); (5) thirty-eight arms, with one IIBr. series missing; the ten IIBr. series are 4 (3+4); ten of IIIIBr. series are 2, six being 4 (3+4); (6) thirty-six arms about 100 mm. long; the ten IIBr. series are 4 (3+4); nine of the IIIIBr. series are 2 and seven are 4 (3+4); nine of the IIIIBr. series are 2 and seven are 4 (3+4) the cirri are 25 mm. to 35 mm. long, composed of 34-42 segments; (7) thirty-six arms about 100 mm. long; five of the IIBr. series are 2 and five are 4 (3+4); eight of the III Br. series are 2 and eight are 4 (3+4); the cirri are 25 mm. to 30 mm. long, composed of 36-40 segments; (8) thirty-four arms about 100 mm. long; the ten IIBr. series are 4 (3+4); the fourteen IIIIBr. series are 2; the cirri are 25 mm. to 30 mm. long, composed of 36-43 segments. The colour in life is recorded as very variable.

Remarks. Unfortunately both *Zygometa elegans* and *Z. microdiscus* vary very considerably in their arm structure, and examples of both may easily be found which possess more or less completely developed the arm structure of the other. For instance, the second specimen listed above has seven of the ten IIBr. series

4 (3+4) and sixteen of the eighteen IIIBr. series 4 (3+4); this would indicate the species *microdiscus*; but there are only forty arms, and the character of the proximal pinnules and of the cirri is identical with that of the proximal pinnules and of the cirri of the eighth specimen, which is in every way a typical example of *elegans*.

In *Zygometra comata* from the East Indies, *Z. andromeda* from India and *Z. punctata* from north Australia and the Aru Islands the characters are very stable and variation is reduced to a minimum; but in the larger forms, as in almost all comatulids with a very large number of arms, the arm structure becomes more or less uncertain and less reliable as a systematic guide than the structure of the lower pinnules or of the cirri.

There appear to be two definite and distinct structural types about which all of the large specimens of *Zygometra* centre, and it therefore seems most logical to recognise two species each with a definite pinnule and cirrus structure, and a definite average arm structure.

Zygometra multiradiata I believe, from an examination of the type in London, to be merely an undeveloped specimen of *Z. microdiscus*. I would now refer to *Z. microdiscus* the specimens which I recorded from northwestern Australia, and from Lewis Island in the Dampier Archipelago.

Fam. : HIMEROMETRIDAE, A. H. Clark.

Genus: AMPHIMETRA, A. H. Clark.

AMPHIMETRA DISCOIDEA, A. H. Clark.

Amphimetra discoidea, 1911. A. H. Clark, The Recent Crinoids of Australia, p. 766
1911, A. H. Clark, Ergebnisse der Hamburger sudwest-Australischen Forschungsreise 1905, Bd. 3, Lief. 13, s. 459. 1912, A. H. Clark, The Crinoids of the Indian Ocean, p. 112.

Locality. Between Fremantle and Geraldton.

Depth. 60-100 fathoms.

Material. Six specimens. These are all large and well developed, the arms being between 185 mm. and 195 mm. long; the centrodorsal is from 6 mm. to 8 mm. in diameter, very broad, with a flat or more or less convex dorsal pole in the centre of

which there is sometimes to be seen a small pit; the cirri are XX-XXXII, the longest with 37-44 segments, and 35 mm. to 40 mm. in length; they are moderately stout and are composed of approximately sub-equal segments of which the longest (in the proximal portion) are from half again to twice as broad as long, and the distal are slightly shorter.

Remarks. The ten armed species of the genus *Amphimetra* are as yet very imperfectly understood. A considerable number of them have been described, mostly based upon single specimens which in several cases are small and probably immature. Extensive material from any one locality commonly shows great variation in one or more of the characters ordinarily used in specific differentiation.

As we know them at present these species appear to fall into three groups; (1) species in which the cirri are very stout with all of the component segments much broader than long, the distal being slightly longer than the proximal (typified by *A. milberti*); (2) those in which the cirri are comparatively slender with the proximal segments never more than twice as broad as long, usually about as long as broad, and always longer than the distal, and in which the dorsal spines on the cirrus segments are small, short and inconspicuous, developed only in the outer portion of the cirri (typified by *A. discoidea*) and (3) those in which the cirri, while in general resembling the cirri of the preceding group, possess large, long and conspicuous dorsal spines which are developed to well within the basal third (typified by *A. jacquinoti*).

The specimens under consideration appear undoubtedly to be exceptionally large and well developed examples of *A. discoidea*; typically *discoidea* has more slender and more tapering cirri in which the longer proximal segments are very nearly or quite as long as broad, but the distal are shorter, broader than long; in typical *milberti* the cirri are much stouter than in these specimens, the segments all being approximately of equal length, though the outer are a trifle longer proportionately, about four times as broad as long.

Fam.: TROPIOMETRIDAE, A. H. Clark.

Genus: TROPIOMETRA, A. H. Clark.

TROPIOMETRA AFRA (Hartlaub).

Tropiometra afra, 1911. A. H. Clark, The Recent Crinoids of Australia, p. 780.
1912, A. H. Clark, The Crinoids of the Indian Ocean, p. 176. 1912,
A. H. Clark, The Crinoids of the Natural History Museum at Hamburg,
p. 28.

Locality. Between Fremantle and Geraldton.

Depth. 60-80 fathoms.

Material. Two specimens; one of these has an arm length of about 220 mm.; the centrodorsal is thick discoidal, 10 mm. in diameter and 4 mm. high interradially; the cirri are XXIII, 34-35, 35 mm. to 40 mm. long; the other is similar, with arms 225 mm. long. The colour in life was dark purplish brown.

Remarks. This species differs from *T. macrodiscus* of southern Japan in its smaller and more slender cirri; *T. afra*, which is represented in the museums of the world by only three specimens other than the two described above, was previously known only from Bowen, Queensland, where two specimens were collected, more than fifty years ago, by the representatives of the famous Godeffroy company of Hamburg; the third specimen was brought home from the "South Pacific" by the United States Exploring Expedition.

Fam: CALOMETRIDAE, A. H. Clark.

Genus: NEOMETRA, A. H. Clark.

NEOMETRA GORGONIA, Sp. Nov.

Locality. Between Fremantle and Geraldton.

Depth. 80-120 fathoms.

Material. Seven specimens.

Description of the type specimen. The centrodorsal is discoidal, broad, with a broad and flat dorsal pole 5 mm. to 6 mm. in diameter; the cirrus sockets are arranged in one and a partial second crowned and irregular marginal row.

The cirri are XIX, 39-50, 35 mm. to 45 mm. (usually about 40 mm.) in length, long, large and stout, with a pronounced taper in the distal half; the first nine or ten segments are half again to twice as broad as long (usually nearer the latter) the first segment being similar to those succeeding; the segments following the ninth or tenth gradually become shorter, but at the tip of the cirrus slowly increase in length again; the tenth has on the dorsal side just within the distal border an inconspicuous slightly elongated median tubercle which on the succeeding slowly transforms into a narrow and low, though prominent, median carination running the entire length of the segment; on the fifteenth two small tubercles appear, one on either side of the median carination just within the distal edge of the segment; these increase in size and elongate, after two or three segments, becoming prominent low narrow keels which resemble the median keel, though they are slightly less in height and do not extend quite so far toward the proximal border of the ossicle; they are not quite parallel to the median keel, but converge slightly toward the proximal end of the segments; distally all three carinate processes increase in height, especially the median, and a tubercle, which may be more or less elongate, usually appears just outside of the distal end of each of the lateral keels; on account of the terminal taper of the cirri the opposing spine and terminal claw are rudimentary.

The radials are short in the median line, but extend upward in the angles of the calyx in the form of broad processes with parallel or slightly converging sides which entirely and widely separate the bases of the IBr.1; these processes are sharply truncated distally, and are not expanded or spatulate.

The division series and arms extend outward almost horizontally from the calyx, as in *Neometra sibogae*.

The IBr.1; are short, oblong, four or five times as broad as long; the ventrolateral edge is produced into a thin border which, viewed dorsally, is seen to run from the distal edge of the interradiial process of the radials to the distal lateral angles of the IBr.1 where it disappears from dorsal view, being continued along the ventral side of the axillary and of the division series forming a deep trough in which the "soft parts" lie. The IBr.2 (axillaries) are broadly pentagonal, nearly twice as broad as long; the lateral

edges are little, if any, shorter than those of the IBr.1, making with them a broadly obtuse angle. The IIBr. and IIIBr. series are 2, and all of the latter are developed.

There are forty arms (thirty-nine in the type) 95 mm. long, resembling those of other species of the genus; there is little or no overlapping of the distal edges of the brachials.

P₁ is 14 mm. long with twenty-eight segments, of which the first two are greatly enlarged, over twice the breadth of the succeeding, with the distal edge more or less convex, the third or third and fourth are slightly broader than long, and the remainder are subequal, slightly longer than broad; as a whole the pinnule is proportionately longer and somewhat stouter and stronger, than is usual in the genus. -

P₂ is 18 mm. long and is composed of nineteen segments: it resembles P₃ but is very slightly less stout.

P₃ is 19 mm. long, very stiff and spine-like, composed of nineteen segments of which the first two are broader than long, slightly enlarged, with distal carinate processes the edges of which are straight and parallel to the longitudinal axis of the pinnule or nearly so, the third is nearly as long as broad, and the following are elongate with, after the eighth, produced distal edges which at the prismatic angles are provided with prominent spines.

P₄ is 14 mm. long and is composed of fifteen segments; it resembles P₃, but is less stout and the two first segments are less enlarged.

P₅ is 10 mm. long, composed of twelve segments; it is more slender than P₄.

The distal pinnules resemble those of the other species of the genus; they are very sharply triangular in cross section and their ambulacra are provided with very highly developed side and covering plates; they measure 9 mm. in length, and are composed of fifteen segments of which the terminal four or five, upon which the ambulacral grooves do not extend, are abruptly smaller than the preceding.

The color in life is white, with purple bars and blotches on the pinnules.

The specimens other than the type. (1) Forty-two arms; there are two IVBr. series, both developed on the inner side of

external IIBr. series; the dorsal pole of the centrodorsal is 6 mm. to 7 mm. in diameter; the cirri are XXII, 44-46, 35 mm. to 40 mm. long; the colour is white, the outer part of the arms narrowly banded, and the pinnules broadly blotched, with purple; (2) forty-one arms about 75 mm. long; the cirri are XX, 39-44, 35 mm. to 40 mm. long; (3) about forty arms 65 mm. long; the cirri are about 30 mm. long; the colour is white, the arms beyond the division series narrowly and regularly banded with purple, the bands being continued on to the pinnules; (4) forty arms 60 mm. long; dorsal pole of the centrodorsal is 5 mm. in diameter; the cirri are XXI, 34-39, 25 mm. long; (5) about forty arms, there are two IVBr. series; (6) forty arms, similar to the preceding.

Comparison with related species. *Neometra gorgonia* is very different from all of the other described species of the genus. As now known the species of this genus, on the basis of the number of their arms, fall into five groups: (1) species having from fifteen to twenty arms (*alecto*); (2) species having twenty arms (*multicolor spinosissima*, *conaminis*); (3) species having thirty arms (*acanthaster*); (4) species having from thirty to forty arms (*sibogae*); and (5) species having forty arms (*gorgonia*). The only species with which this can possibly need comparison is *N. sibogae*.

On the terminal twelve or thirteen cirrus segments in *N. sibogae* the high median carination is accompanied on either side by a usually more or less elongate tubercle which, however, is comparatively small and inconspicuous. I did not notice this until my attention was called to the similar, but far more prominent, processes in *N. gorgonia*.

In *N. sibogae* the edges, both proximal and distal, of the elements of the division series and the proximal brachials, and the distal edges of the brachials and of the cirrus segments are prominently everted, giving the animal a curiously ornate appearance; in *N. gorgonia* the edges of the elements of the division series, brachials and cirrus segments are smooth, so that the general aspect of the two forms is strikingly different; the cirri of *N. gorgonia* are very much longer than, in fact nearly twice as long as, the cirri of *N. sibogae*, and the three keels on the dorsal side of the outer segments are very much more strongly marked; the cirrus segments in *N. gorgonia* are much more numerous than in *N. sibogae*.

NEOMETRA CONAMINIS, Sp. Nov.

Locality. Between Fremantle and Geraldton.

Depth. 80-120 fathoms.

Material. Four specimens.

Description of the type specimen. The centrodorsal is of medium size, discoidal, the dorsal pole flat, 4.5 mm. in diameter; the cirrus sockets are arranged in a single more or less irregular marginal row (in one of the other specimens there is also a very deficient second row).

The cirri are XIV (in the other specimens varying from XIV to XIX), 40-45, 25 mm. long; the longer earlier segments are half again as broad as long to nearly as long as broad, and the shorter distal segments are about three times as broad as the median length, becoming longer again terminally; the cirri are not particularly stout; they taper slowly and gradually throughout their whole length; on the sixth or seventh segment the median dorsal portion of the distal edge becomes slightly prominent; this prominence rises in height and slowly extends itself proximally until on about the tenth there results a narrow median keel running the whole length of the dorsal surface; on the succeeding segments this gradually increases in height, becoming the high thin median carination characteristic of the outer cirrus segments of the species of this genus; the ventral surface of the cirri is rather narrowly rounded so that in cross section the cirri are seen to approach a rhombic shape, but with the four angles of the rhombic outline very broadly rounded.

The radials are concealed in the median line, but extend upward in the angles of the calyx in the form of triangular processes of which the sides, which are about as long as the bases, are concave and the apices are truncated; the apices of these triangular processes entirely, though not very widely, separate the bases of the IBr.1.

The IBr. 1 are very slightly trapezoidal, almost oblong, from three to four times as broad as long; the ventrolateral edges, though sharp, are only very slightly if at all produced; these ossicles occasionally bear an obscure low median keel; the IBr.2 (axillaries) are broadly pentagonal, slightly broader than long, the lateral edges usually slightly shorter than those of the IBr.1.

The twenty arms, which resemble those of related species, are from 85 mm. to 90 mm. long.

P₁ is 9 mm. long, composed of from twenty-five to thirty segments of which the first two are greatly enlarged and the remainder are slightly longer than broad; P₂ is 12 mm. long, with sixteen or seventeen segments which after the third become much elongated, those in the outer part of the pinnule having produced distal edges bearing prominent spines at the prismatic angles; the pinnule is stiff and spine-like; P₃ is from 15 mm. to 17 mm. long with from sixteen to eighteen segments, resembling P₂ but proportionately larger; P₄ is 17 mm. long with eighteen segments, similar to P₃; P₅ is 12 mm. long with fifteen segments, similar to the preceding; P₆ is 10 mm. long with fourteen segments; the distal pinnules are about 11 mm. long.

The colour in life is white with yellow bands on the arms and pinnules, more rarely on the cirri.

The specimens other than the type. Three, all with twenty arms, and all resembling the type.

Comparison with related species. The species of the genus *Neometra* at present known are seven in number; they may be briefly diagnosed as follows:—

Neometra alecto; Fifteen to twenty arms, 60 mm. to 70 mm. long; cirri IX-XV, 39-46, 25 mm. to 30 mm. long (Philippine Islands; 42-58 fathoms).

Neometra multicolor; Twenty arms, 60 mm. long, cirri XV, 35, 20 mm. long (southern Japan; 20-110 fathoms).

Neometra conaminis; Twenty arms, 85 mm. to 90 mm. long; cirri XIV-XIX, 40-45, 25 mm. long (southwestern Australia; 80-120 fathoms).

Neometra spinosissima; Twenty arms, 130 mm. long; cirri XI, 42-55, 25 mm. long (Andaman Islands).

Neometra acanthaster; Thirty arms, 60 mm. long; cirri 20 mm. long, ventrally carinate (Philippine Islands; 49 fathoms).

Neometra sibogae; Thirty to forty arms, 70 mm. to 75 mm. long; cirri XV, 31-36, 25 mm. long; edges of all the ossicles produced; terminal cirrus segments with triple dorsal processes (Solor Strait, east of Flores; 113 metres).

Neometra gorgonia; Forty arms, 95 mm. long; cirri XIX, 39-50, 35 mm. to 45 mm. long; edges of all the ossicles smooth; all of the dorsal processes on the cirrus segments triple, the terminal often with two additional elements (south-western Australia; 80-120 fathoms).

From an examination of the data given above it is evident that *N. conaminis* belongs to the group of species characterized by the possession of twenty arms, including *N. alecto*, *N. multicolor*, and *N. spinosissima*.

The Japanese *N. multicolor* is much smaller than *N. conaminis*, and possesses shorter cirri with considerably fewer segments; *N. spinosissima* from the Andaman Islands is much larger with proportionately shorter cirri which have more numerous segments; *N. alecto* is of about the same size as *N. conaminis*, and possesses cirri with the same number of segments; the cirri of *N. alecto* are proportionately noticeably longer and more slender than are those of *N. conaminis*, while the brachials and cirrus segments have slightly produced distal edges, these being smooth in *N. conaminis*.

Fam: THALASSOMETRIDAE, A. H. Clark.

Genus: Ptilometra, A. H. Clark.

PTILOMETRA MACRONEMA, J. Müller.

Ptilometra macronema, 1911. A. H. Clark, Bull. du mus. d'hist. nat. de Paris, No. 4, 1911, p. 255, fig. i B, p. 256. 1911, A. H. Clark, The Recent Crinoids of Australia, p. 781. 1911, A. H. Clark, Ergebnisse der Hamburger sudwest-Australischen Forschungreise, 1905, Bd. 3, Lief. 13, S. 461. 1912, A. H. Clark, The Crinoids of the Indian Ocean, p. 189.

Locality. Off Geraldton; "very abundant."

Depth. 25-40 fathoms.

Material. Ten specimens, all of medium size, the arms being 45 mm. to 55 mm. in length from the radials and the longest cirri about 45 mm. long, composed of 69-78 segments; six of the examples have twenty arms, two have nineteen, one has sixteen and one has fourteen.

The colour in life is recorded as purple, the cirri red. In spirits the colour is yellowish-brown, the cirri becoming deep purple in the outer half.